Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme : Bachelor of Science
Specific Programme : Physics

[S.Y.B.Sc. Physics]

Revised under Autonomy
From academic year 2022 - 2023

VPM's B.N.Bandodkar College of Science (Autonomous), Thane

S.Y. B.Sc. (Physics) Proposed Syllabus

Structure of Programme-22-23

CourseCode	Course Title	No. of lectures	Credits
BNBUSPH3T1	Mechanics and thermodynamics	45	2
BNBUSPH3T2	Vector calculus, Analog Electronics	45	2
BNBUSPH3T3 (Elective)	Applied Physics -I /Solar Energy and Measurement	45	2
BNBUSPH3P1	Practical I	45	2
	Total	180	8

CourseCode	Course Title	No. of lectures	Credits
BNBUSPH4T1	Optics and Digital Electronic	45	2
BNBUSPH4T2	Quantum Mechanics	45	2
BNBUSPH4T3 (Elective)	Applied Physics-II /Solar Energy Applications and Analysis	45	2
BNBUSPH4P1	Practical II	45	2
	Total	180	8

Preamble

The updated courses presented in this paper are student-centred and aid students in comprehending basic natural laws and developing the necessary abilities to apply them to further areas of study. There are a few core or required physics courses such as Mechanics and thermodynamics, Vector calculus, Analog Electronics, Applied Physics-II / Solar Energy and Measurement, Optics and Digital Electronics, Quantum Mechanics, Applied Physics-II / Solar Energy Applications and Analysis, Quantum Mechanics, Applied Physics-II / Solar Energy Applications and Analysis, Quantum Mechanics, Applied Physics-II /

Students will be able to apply what they've learned in advanced courses as well as in industrial and research settings. The theory courses are supplemented by the relevant laboratory / hands-on courses, which provide students with first-hand, do-it-yourself training and enable them to better understand the Physics fundamentals. This also allows students to pursue their passion for learning Physics. There will be elective courses in addition to the core courses that will assist students strengthen their abilities through hands-on activities as they go through the programme.

Semester III

Course Code	Course Title	Credits	No. of lectures
BNBUSPH3T1	Mechanics and thermodynamics	2	
Course Outcomes	**On successful completion of this course, students will be able to :** **i) Understand the concepts of mechanics & properties of matter & to apply them to problems.** **ii) Comprehend the basic concepts of thermodynamics & its applications in physical situation.** **iii) Learn about situations in low temperature.** **iv) Demonstrate tentative problem solving skills in all above areas.**		45

UNIT 1	i) Safety in a Mechanical Industry General information Industrial safety, Introduction to factory act, Introduction to Mines act, Introductions to Workmen's compensation act.	15
	ii) Compound pendulum : Expression for period, maximum and minimum time period, centres of suspension and oscillations , reversible compound pendulum. Kater's reversible pendulum , compound pendulum and simple pendulum- a relative study iii) Center of Mass, Motion of the Center of Mass , Linear momentum of a Particle Linear momentum of a System of Particles, Linear momentum wrt CM coordinate (i.e shift of origin from Lab to CM), Conservation of Linear Momentum , Some Applications of the Momentum Principle , System of Variable Mass Torque Acting on a Particle , Angular Momentum of a Particle , Angular Momentum of System of Particles , Total angular momentum wrt CM coordinate. Conservation of Angular Momentum [DELETED] iv) Oscillations: The Simple Harmonic Oscillator , Relation between Simple Harmonic Motion and Uniform Circular Motion,[DELETED]Two Body Oscillations, Damped Harmonic Motion , Forced Oscillations and Resonance.	

UNIT-2	Review of zeroth and first law of thermodynamics i) Conversion of heat into work, heat engine, Carnot's cycle: its efficiency, ii) Second law of thermodynamics, Statements, Equivalence of Kelvin and Plank statement, Carnot's theorem, Reversible and irreversible process, Absolute scale of temperature. iii) Clausius theorem, Entropy, Entropy of a cyclic process, Reversible process, Entropy change, Reversible heat transfer, Principle of increase in entropy, generalized form of first and second law, entropy change of an ideal gas, entropy of steam, entropy and unavailable energy, entropy and disorder, absolute entropy iv) Third law of thermodynamic Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion .	15
UNIT-3	i) Steam engine, Rankine cycle, Otto engine, Efficiency of Otto cycle, Diesel cycle, Efficiency of Diesel cycle, Otto and diesel comparison ii) Low temp Physics: Different methods of liquefaction of gases, methods of freezing, Cooling by evaporation, cooling by adiabatic expansion Joule - Thompson effect, JT effect of Van der Waal's gas, Liquefaction of helium, properties and uses of liquid Helium iii) Third law of thermodynamic Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion	15

	Books And References				
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1	Physics – I	Resnick and Halliday :			
2	Mechanics –,	H. S. Hans and S. P. Puri	Tata McGraw Hill	(2ndED.)	
3	Heat thermodynamics and Statistical Physics	Brijlal, N.Subramanyam, P. S. Hemne,	S. Chand	Edition 2007.	
4	Basic Thermodynamics	Evelyn Guha	(Narosa Publications)		
5	Mechanics and Electrodynamics	Brijlal and Subramanyan and Jeevan Seshan		Rev Edn.	2005
6	Government of India. (1948, April 19). Employees' state insurance act, 1948. Retrieved June 2, 2014, from Employees' State Insurance Corporation, Karnataka: http://www.esickar.gov.in/esi_act.pdf				

7	Government of India. (1948, September 23). The factories act. Retrieved June 3, 2014, from Dept of Labour, Government of Punjab: http://pblabour.gov.in/pdf/acts_rules/factories_act_1948.pdf				
8	Government of India. (1952, March 15). The mines act. Retrieved June 3, 2014, from Legal Office: FAOLEX: http://faolex.fao.org/docs/pdf/ind132410.pdf				
9	Government of India. (1955, July 2). The mines rules. Retrieved June 3, 2014, from Ministry of Coal, Govt of India: http://coal.nic.in/weboflife-minesafety/mr.pdf				
10	Government of India. (1923, March 5). The workmen's compensation act, 1923. Retrieved June 3, 2014, from Ministry of Labour and Employment, Govt of India: http://labour.nic.in/upload/uploadfiles/files/ActsandRules/SocitySecurity/TheWorkmenAct1923.pdf				

Course Code	Course Title	Credits	No. of lectures
BNBUSPH3T2	Vector calculus, Analog Electronics	2	
Course Outcomes	**On successful completion of this course students will be able to :** **1) Understand the basic concepts of mathematical physics and their applications in physical situations.** **2) Understand the basic laws of electrodynamics and be able to perform calculations using them.** **3) Understand the basics of transistor biasing, operational amplifiers, their applications** **4) Understand the basic concepts of oscillators and be able to perform calculations using them.** **5) Demonstrate quantitative problem solving skill in all the topics covered.**		**45**

Unit-1	Vector Calculus:	15
	1. Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence , The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done. 2. Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates	

Unit-2	Analog Electronics	15
	1.Transistor Biasing, Inherent Variations of Transistor Parameters, Stabilisation, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias. 2.General amplifier characteristics: Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance, general theory of feedback, reasons for negative feedback, loop gain. 3.Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width.	
Unit-3	Analog Electronics	15
	1. Oscillators: Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator 2. Operational Amplifiers: Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator	

Books and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Introduction to Electrodynamics	D.J. Griffith		3rd Ed	
2	Principles of Electronics	– V. K. Mehta and Rohit Mehta.	(S. Chand –	Multicoloured illustrative edition)	
3	Electronic devices and circuits – An introduction –	Allan Mottershead	(PHI Pvt. Ltd.– EEE		Reprint – 2013)

Course Code	Course Title	Credits	No. of lectures
BNBUSPH3T3	Applied Physics-I	2	
Course Outcomes	**On completion of this, it is expected that i) Students will be exposed to contextual real life situations. ii) Students will appreciate the role of Physics in 'interdisciplinary areas related to materials and Acoustics etc.**		45

	iii) The learner will understand the scope of the subject in Industry & Research. iv) Experimental learning opportunities will faster creative thinking & a spirit of inquiry.		

Unit-1	Acoustics, LASER and fibre optics	15
	1. Acoustics of Buildings: Reverberation, Explanation of Sabine's formula, & Importance of Sabine's Formula, Absorption Coefficient, Acoustics of Buildings, Factors Affecting Acoustics of Buildings, Sound Distribution in an Auditorium. RK: 5.9, 5.10, 5.12, 5.13, 5.14 & 5.15 2. Laser: Introduction, transition between Atomic energy states, Principle of Laser, Properties of Laser: Coherence Properties of LASER, Spatial Coherence Length, Directionality, Intensity, Helium–Neon Laser, Application of Laser, Holography SP: 9.1, 9.2, 9.3, 9.4, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.6& 9.10 3. Fibre Optics: Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Optical Fibres. SP: 13.3, 13.3.1, 13.3.2, 13.3.3, 13.5 & 13.9	
Unit-2	Crystal Physics	15
	1) Lattice points and space lattice, The basis and crystal structure, Unit Cells and lattice parameters, Primitive Cells, Crystal Systems, Crystal Symmetry, Bravais space lattices 2) Metallic crystal structures, relation between the density of crystal material and lattice constant in a cubic lattice, Directions, Planes, Miller Indices, Important planes in simple cubic structure, separation between lattice planes in a cubic crystal.	
Unit-3	Properties of Material	15
	1) Electrical properties: Review of energy band diagram for materials – conductors, semiconductors and insulators, Electrical conductivity in metals, semiconductors and insulators (dielectrics), effect of temperature on conductivity. 2) Optical properties: Reflection, refraction, absorption and transmission of electromagnetic radiation in solids. 3) Magnetic properties: Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism),magnetic hysteresis. 4) Applications: Dielectric materials: Piezoelectric, ferroelectric and pyroelectric materials	

Books and References	Title	Author/s	Publisher	Edition	Year

1	**SP**: Modern Physics Concept and Applications	Sanjeev Puri,	Narosa Publication.		
2	**RK**: Properties of matter and Acoustics	R Murugeshan and K. Shivaprasath, S	Chand &Co.Ltd.		(2005-Ed)
3	SOP : Chapter 4 : II,III,IV,V, VI, VII, XIV,XV, XVI, XVIII, XX, XXII, XXV, XXVI				
4	Electronic Properties of Materials,	Rolf E Hummel.			
5	Materials Science and Engineering: A First Course	V. Raghavan.			

Course Code BNBUSPH3T3	Course Title Solar Energy and Measurement	Credits 2	No. of lectures
Course Outcomes	The purpose of this course is to raise awareness among students about the usage of non-conventional energy source such as solar. Course is aimed to introduce the students to the nature of the energy that originates from the Sun, capable enough to drive nearly all the systems found on the Earth. This course enables the students to realize importance and utilization of the abundantly available solar energy as an alternative non-conventional energy source.		45

Unit-1	**Energy**	15
	Definition, World energy futures, Classifications of energy sources, energy sources and their availability, Conventional energy sources coal, oil, gas, agriculture and organic waste, water power nuclear power and nonconventional energy sources Solar energy, Wind energy, Bio mass and Bio gas energy Geothermal and Hydrogen Energy, Limitation of different energy sources. G. D. Rai- 1.3, 1.4, 1.4.2, 1.6,1.6.1, 1.6.3, 1.6.4, 1.8, 1.9	

Unit-2	**Origin of Solar Energy**	15
	Basic Parameters of Sun, Distances, Mass, Radius, Emission Power, Surface Temperature and Composition, The Kelvin-Helmholtz Model, Energy Sources of The Sun, The p-p chain, Carbon Chain, Internal Structure of the sun. Solar cell, Construction of Solar Cell,Working Principle of Solar Cell, Types of Solar cell-Monocrystalline and Polycrystalline Silicon solar cell,thin-film solar cells. C. Julian Chen - 3.1[3.1.1-3.1.6], 3.2, 3.3[3.3.1-3.3.3]	
Unit-3	**Solar radiation, Geometry and measurement**	15
	Solar radiation, Solar constant, Beam and Diffused radiation, terrestrial radiation, extra-terrestrial radiation, Solar Radiation Geometry- Altitude angle, Zenith angle, Solar Azimuth angle, The Slope, The surface Azimuth angle, Incident angle, Day Length, Solar Radiation Measurement-Pyrheliometers, Angstrom, Abbot silver disc and Eppley, Pyranometers-Eppley Pyranometers, Yellot Solarimeter[Photovoltaic solar cell] Average value of Horizontal Solar radiation ,Solar radiation on the tilted surface. G. D. Rai - 2.1, 2.2, 2.3, 2.3.4, 2.4.1- 2.4.7, 2.6.1, 2.6.2, 2.9, 2.10.	

Books and References	Title	Author/s	Publisher	Edition	Year
1	Non- Conventional sources of Energy- A textbook of Engineering students	G. D. Rai	Khanna Publishers, ISBN No.: 978-81-7409-073-8.	Sixth Edition:	2017
2	Physics of Solar Energy.	C. Julian Chen.	Published by John Wiley & Sons, Inc., Hoboken, New Jersey.		2011

Course Code	Course Title	Credits	No. of lectures
BNBUSPH3P3	Practical course -3	2	
Course Outcomes	**On successful completion of this course students will be able to :** **i) Understand & practice the skills while performing experiments.** **ii) Understand the use of apparatus and their use without fear & hesitation.** **iii) Correlate the physics theory concepts to practical**		45

	application. iv) Understand the concept of errors and their estimation.		

	Group A	
Practical 1	Y by bending.	3
Practical 2	Kater's pendulum	3
Practical 3	Searle's experiment: determination of Y and μ.	3
Practical 4	Flat spiral spring (Y)	3
Practical 5	Flat spiral spring (n)	3
Practical 6	Determination of thermal conductivity of bad conductor by Lee's Method	3
Practical 7	Helmholtz resonator- determination of unknown frequency	3
Practical 8	Verification of Stefan's law (Electrical method)	3
Practical 9	I-V characteristics Of Solar Cell.	3
Practical 10	Power load characteristics Of Solar Cell.	3
	Group-B	3
Practical 1	1. Passive low pass filter	3
Practical 2	2. Passive high pass filters.	3
Practical 3	3. Passive band pass filter.	3
Practical 4	4. Opamp: Inverting amplifier with different gains	3
Practical 5	5. Opamp: Non-inverting amplifier with different gains and voltage follower	3
Practical 6	CE amplifier: determination of bandwidth	3
Practical 7	CE amplifier: variation of gain with load	3
Practical 8	Wien bridge oscillator	3
	Group-C	
Practical 1	Laser experiments: straight edge, single slit, ruler grating	3
Practical 2	Concept of beats	3
Practical 3	Standardization of pH meter & acid-base titration.	3
Practical 4	Optical fibre: transmission of signal	3

		Skill Experiment	9
1		Soldering technique	
2		Wiring of a simple circuit using bread board	
3		Use of DMM	
4		Use of oscilloscope	
5		Travelling microscope (Radius of capillary)	
6		Spectrometer: mean μ of yellow doublet of mercury source.	
7		Spectrometer: optical leveling and Shuster's method	
8		Component testing, colour code of resistors, capacitors etc.	
9		Drawing of graph on semi logarithmic / logarithmic scale.	
10		Radius of ball bearings (single pan balance)	

Books and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Advanced course in Practical Physics	D. Chattopadhya, PC Rakshit& B Saha.	Book and Allied Pvt.Ltd.	(6th Edition)	
2	B.Sc Practical Physics –	Harnam Singh	S.Chand& Co. Ld.		2001
3	A test book of advanced practical PHYSICS _	SAMIR Kumar Ghosh,	New Central Book Agency	(3rd edition)	
4	B.Sc. Practical Physics	CL Arora	S.Chand and Co Ltd.	1st Edition	- 2001
5	Practical Physics	CL Squires	Cambridge University	(3rd Edition)	
6	University Practical Physics	DC Tayal.	Himalaya Publication		
7	Advanced Practical Physics	Worsnop&Flint			

Semester IV

Course Code	Course Title	Credits	No. of lectures
BNBUSPH4T1	Optics and Digital Electronics	2	
Course Outcomes	**Learning Outcomes:** **On successful completion of this course students will be able to :** **1) Understand the diffraction and polarization processes and applications of them in physical situations.** **2) Understand the applications of interference in design and working of interferometers.** **3) Understand the resolving power of different optical instruments.** **4) Understand the working of digital circuits** **5) Use IC 555 time for various timing applications.** **6) Demonstrate quantitative problem solving skills in all the topics covered.**		45

Unit-1	**Diffraction:**	15

	Background knowledge (devote one lecture at commencement):
	   i. Introduction, Huygens's - Fresnel theory, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction.
	   ii. Introduction of Polarization, Natural light is unpolarized, Unpolarized and Polarized light
	   iii. Brewster's law , Polaroid sheets
	   iv. Prism and grating spectra , Cornu's spiral, Fresnel's integrals.
	Diffraction:
	Fresnel's Diffraction: Fresnel's assumptions, Rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow(straight edge), Diffraction due to a narrow slit, Diffraction due to a narrow wire
	Fraunhoffer Diffraction : Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima	

Unit-2	**Polarization:** Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light, Polarization by reflection from dielectric surface, Polarization by refraction –pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction, Polarizer and Analyzer, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Huygens' explanation of double refraction, Ordinary and Extra ordinary rays, Positive and Negative crystals, Superposition of waves linearly polarized at right angles, Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Production of linearly polarized light,Production of elliptically polarized light, Production of circularly polarized light, Analysis of polarized light, Applications of polarized light.	15
Unit-3	Digital Electronics:	15
	Background knowledge (devote one lecture at commencement): i. Binary number system , Arithmetic building blocks , Types of registers Digital IC signal levels, Binary to Decimal ,Decimal to binary , Hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition, Unsigned binary numbers, Sign magnitude numbers , 1's complement , 2's complement , Converting to and from 2's complement representation , 2's complement arithmetic, The adder-subtractor (ignore IC specific diagrams) RS Flip-Flops (only NOR gate latch, NAND gate latch) , Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop, Edge-Triggered J-K Flip-Flop, JK Master- Slave Flip-Flops, Bounce elimination switch Types of registers : SISO , SIPO, PISO , PIPO [in this chapter the teacher should make all IC specific diagrams into general diagrams ie. Ignore pin numbers and IC numbers] Asynchronous counter -3 bit (ignore IC specific diagrams), Synchronous counter only mod 8, Decade Counters Mod5 and Mod10	

Books and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	A Text Book Of Optics	Dr.N.Subrahmanyam, Brijlal, Dr M.N. Avadhaanulu	S.Chand	25thRevised edition	2012 Reprint 2013)
2	OPTICS	AJOYGHATAK		(5thEdition)	
3	LMS – Digital Principles and Aplications	Leach, MalvinoSaha		6th edn	
4	TF – Digital Fundamentals	Thomas L Floyd		10th edn.	
5	RPJ – Modern Digital	R P Jain		4th edn.	

	Electronics				

Course Code	Course Title	Credits	No. of lectures
BNBUSPH4T2	QUANTUM PHYSICS	2	
Course Outcomes	**On successful completion of this course students will be able to :** **1) Understand the postulates of quantum mechanics and to understand its importance in explaining significant phenomena in Physics.** **2) Demonstrate quantitative problem solving skills in all the topics covered.**		**45**

Unit-1	Background Reading (Review): Origin of Quantum Mechanics: 1) Review of Black body radiation, b) Review of photoelectric effects. 2) Matter waves-De Broglie hypothesis. Davisson and Germer experiment. 3. Wave particle duality 5. Concept of wave packet, phase velocity, group velocity and relation between them 6. Heisenberg's uncertainty principle with thought experiment, different forms of uncertainty.	15
	The Schrodinger wave equation	
	1. Concept of wave function, Born interpretation of wave function. 2. Concepts of operator in quantum mechanics examples – position, momentum and energy operators. 3. Eigenvalue equations, expectation values of operators. 4. Schrodinger equation. 5. Postulates of Quantum Mechanics. 6. Analogy between Wave equation and Schrodinger equation. 7. Time dependent and time independent (Steady State) Schrodinger equation, Stationary State 8. Superposition principle. 9. Probability current density, Equation of continuity and its physical significance	
Unit-2	Applications of Schrodinger steady state equation	15
	1. Free particle. 2. Particle in infinitely deep potential well (one - dimension). 3. Particle in finitely deep potential well (one - dimension). 4. Step potential. 5. Particle in three dimension rigid box, degeneracy of energy state.	
Unit-3	Applications of Schrodinger steady state equation –II	15

	1. Potential barrier (Finite height and width) penetration and tunneling effect (derivation of approximate transmission probability) 2. Theory of alpha particle decay from radioactive nucleus. 3. Harmonic oscillator (one-dimension), correspondence principle.	

Book and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Concepts of Modern Physics –	A. Beiser	Tata McGraw Hill.	(6th Ed.)	
2	Quantum Mechanics –, -	S P Singh, M K Bagade, Kamal Singh	S. Chand :	2004 Ed.	
3	Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. -	By R. Eisberg and R. Resnik	Wiley.		
4	Introduction to Quantum Mechanics. -	D. Griffiths	Prentice Hall.		
5	Quantum Mechanics. -	Ghatak and Lokanathan	Published by Mc. Millan.		
6	Quantum Mechanics. -	L. I. Schiff			
7	Quantum Mechanics. -	Powell and Crasemann, Addison-	Wesley Pub. Co.		

Course Code BNBUSPH4T3	Course Title Applied Physics - II	Credits 2	No. of lectures
Course Outcomes	On successful completion of this course, students will be able to: i) Understand the concepts of mechanics & properties of matter & to apply them to problems. ii) Comprehend the basic concepts of thermodynamics & its applications in physical situation. iii) Learn about situations in low temperature. iv) Demonstrate tentative problem solving skills in all above		45

	areas.	

Unit-1	**Introduction to Geology and Geophysics**	15
	CHAPTER 1: GEOLOGY 1.1 Introduction to Geology its branches and relationship with other sciences. 1.2 Earth and solar system: Meteorites and other extra-terrestrial materials. 1.3 Age of Earth and various methods of determination. Planetary evolution of the Earth and its internal structure: Elastic waves and variation of physical and chemical properties in the interior of Earth. 1.4 Major tectonic features of the ocean oceanic and continental crust. 1.5 Continental drift – geological and geophysical evidence: mechanisms, objections and present status. 1.6 Geodynamics of the Indian plate. CHAPTER 2: GEOPHYSICS 2.1 Introduction to Geophysics 2.2 Gravity and magnetic anomalies at Mid-ocean ridges: deep sea trenches, continental shield areas and mountain chains. 2.3 Geomagnetism, elements of Earth's magnetism: Internal, external fields and their causes, Palaeomagnetism, Polar wandering paths and reversals, Seafloor spreading and Plate tectonics. 2.4 Seismic belts of the Earth: Seismicity and plate movements. 2.5 Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources. Geophysical potential fields: Principles of Gravity and Magnetic methods. 2.6 Instrumentation, field procedures used in geophysical studies.	
Unit-2	**Microprocessors**	15
	1) Building Concept of Microprocessor Introduction, Study of Memory, Input Device , Output Device , Input/output Device Central Processing Unit. Chapter 3 : 3.1 , 3.2 , 3.3 (3.3.1 , 3.3.2 , 3,.3.3) , 3.4. , 3.5 , 3.6 , 3.7 2) 8085 Microprocessor Introduction , Features of Inter 8085 , Pin Diagram of 8085 , 8085 CPU Architecture , Arithmetic and Logical Group (ALU , Accumulator , Temporary Register , Flag Register (PSW)) , Register Group (Temporary Registers (W and Z) , General purpose registers , Special Purpose registers) , Interrupt Control , Serial I/O Control Group , Instruction Register , Decoder and Control Group (Instruction Register , Instruction Decoder , Timing and Control) Chapter 4 : 4.1 ,4.2 , 4.3. , 4.4 , 4.5 (4.5.1 , 4.5.2 , 4.5.3 , 4.5.4) , 4.6 (4.6.1 , 4.6.2 , 4.6.3) ,4.7 , 4.8 , 4.9 (4.9.1 , 4.9.2 , 4.9.3) 3) 8085 Instruction Set Introduction , Flowchart , Classification of Instruction Set (Data Transfer Group , Arithmetic Group , Logical Group , Branching Group , Stack and Machine Control	

	Group) , Notations used in Instructions and Opcode , Data Transfer Group , Program Examples for Data Transfer Group , Arithmetic Operation Group , Branch Group , Logical Group , Addressing Modes , 8085 Programmers Model. Chapter 6 : 6.1 , 6.2 , 6.3 6.4 , 6.5 , 6.6 , 6.7 , 6.8 (6.8.1 , 6.8.2 , 6.8.3 , 6.8.8 , 6.8.9, 6.8.10 , 6.8.11 (A part Block Transfer) , 6.9 (6.9.1 upto 6.9.19) , 6.12 , 6.13	
Unit-3	Radio communication	15
	1) Basics of Communication: Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, base band and broad band communication. Noise concept and types, signal to noise ratio, noise figure, noise temperature. 2) Amplitude Modulation: Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, demodulation principles. AM Receiver: TRF and super heterodyne receiver. 3) Frequency Modulation: Definition, mathematical representation, frequency spectrum, bandwidth and modulation index. 4) Concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM.	

Books and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	1. Geomagnetism: Solid Earth and Upper Atmosphere Perspectives.	Nathani Basavaiah,	Springer		(2011).
2	Introduction to Applied Geophysics: Exploring the Shallow Subsurface.	H.R. Burger, A.F. Sheehan and C.H. Jones.	W.W. Norton, New York		(2006).
3	Earth Science.	E.J. Tarbuck, F.K. Lutgens and D. Tasa,	Prentice & Hall		(2005)
4	Mantle Plumes and Their Record in Earth History.	K.C. Condie,	Cambridge University Press, Cambridge, UK		(2001)
5	5. The Magnetic Field of the Earth: Paleomagnetism, the Core, and the	R.T. Merrill, M.W. McElhinny and P.L. McFadden,	International Geophysical Series 63, Academic		(1996

	Deep Mantle.		Press		
6	Applied Geophysics (Paperback).	W.M. Telford, L.P. Geldart and R.E. Sheriff,	Cambridge University Press, Cambridge		1990
7	V.J. Vibhute& P.B. Borole, -U-2			Fifth Revised Edition	
8	Communication Electronics: Principles and applications by	Louis E Frenzel	TMH Publications.		3rd edition
9	Electronics Communication Systems	by Kennedy			
10	Telecommunication Switching Systems and Network	Vishwanathan and Thiagarajan,	PHI publication.		
11	Electronics Communication Systems	by Denis Roddy and John Coolen,	PHI publication.		

Course Code BNBUSPH3T3	Course Title Solar Energy Applications and Analysis	Credits 2	No. of lectures
Course Outcomes	Solar thermal, Solar photovoltaic (PV) application provides practical information. Energy analysis of solar systems will be trained the students to harvest these non-conventional energy source. With the basic knowledge student may design their own gadgets to convert and use them for their house hold purposes.		45

Unit 1	Solar thermal and application	
	Overview, Applications for solar thermal energy, Flat plate solar collector, Flat plate solar	15

	water heater, Flat plate solar space heater, concentrating collector / Focusing collector, Solar thermal power plant, Solar distributed collector power plant, Solar central receiver power plant, Thermal energy storage for solar heating and cooling, Types of TES- Sensible heat storage, Latent heat storage, Solar thermal energy's limitations. Unit 1 2.2, 2.2.1, 2.2.2, 2.2.3, 2.3, 2.3.1, 2.3.2,2.4.	
Unit 2	**Solar photovoltaic (PV) and application**	
	Solar photovoltaic (PV) energy conversion / Photovoltaic effect, Performance analysis of solar photovoltaic (PV) Cell, Current in a short circuit, voltage in an open circuit, Power delivered to the load, Maximum current, Maximum power, Efficiency of solar cell, Fill factor, Limitation of Solar Cell, Solar cell material, Solar cell, Solar module & Solar array, Solar power plant, Autonomous solar power plant / off grid power plant, Grid connected Solar power plant, Solar photovoltaic (PV) energy conversion limitations Unit 2 3.1, 3.2, 3.2.1, 3.2.2. 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.3, 3.4, 3.5, 3.5.1, 3.5.2,3.6.	15
Unit 3	**Energy analysis of solar systems**	
	Energy indices, Embodied energy, Energy Pay Back Time (EPBT), Electricity Production Factor (EPF), Life Cycle Conversion Efficiency (LCCE), Case study: Energy analysis of roof-top photovoltaic (PV) system, Energy analysis of solar evaporative cooling system, Energy analysis of solar day illumination system Unit 3 5.1, 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.2, 5.3, 5.4.	15

Books and References					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	SOLAR ENERGY- Fundamentals, Economic and Energy Analysis	Saurabh Kumar Rajput	NITRA	First Edition	2017 ISBN: 978-93—81125-23—6.

Course Code	Course Title	Credits	No. of lectures

BNBUSPH4P4	Practical course -4	2	
Course Outcomes	**On successful completion of this course students will be able to :** **i) Understand & practice the skills while performing experiments.** **ii) Understand the use of apparatus and their use without fear & hesitation.** **iii) Correlate their physics theory concepts to practical application.** **iv) Understand the concept of errors and their estimation.**		**45**

	Group A	
Practical 1	Fresnel's bi-prism: determination of λ	**3**
Practical 2	Determination of Cauchy's constants.	**3**
Practical 3	R.P. of telescope.	**3**
Practical 4	R.P. of grating	**3**
Practical 5	R. P. of prism	**3**
Practical 6	Brewster's law: determination of μ	**3**
Practical 7	Double refraction	**3**
Practical 8	**Effect of Color (Wavelength) on Cell Current.**	**3**
Practical 9	**Effect of Shading on Cell Current – PV Cells in Series, PV Cells in Parallel with 1 cell covered and all cell covered.**	**3**
Practical 10	**Study Effect of Distance on Cell Current.**	**3**
	Group B	
Practical 1	Half adder and full adder (7486, 7408)	**3**
Practical 2	Study of 3:8 Decoder (74LS138)	**3**
Practical 3	Study of 8:3 Priority Encoder (74LS148)	**3**
Practical 4	Transistorized Astable multivibrator	**3**
Practical 5	Transistorized Monostable multivibrator	**3**
Practical 6	Transistorized Bistable multivibrator	**3**
Practical 7	Op-Amp as Astable multivibrator	**3**

Practical 8	IC 555 timer as Astable multivibrator	**3**
Practical 9	IC 555 timer as Monostable multivibrator	**3**
Practical 10	IC 555 timer as a Ramp generator	**3**
	Group C	
Practical 1	Study of 8085 microprocessor kit and commands.	**3**
Practical 2	2. 8 -bit addition, subtraction, multiplication	**3**
Practical 3	Twodigit Decimal addition, subtraction.	**3**
Practical 4	Memory block transfer from one location to another.	**3**
Practical 5	Find largest/smallest number in given block.	**3**
Practical 6	Find number of positive/negative, odd/even elements in given block.	**3**
Practical 7	Arrange given number in ascending/descending order	**3**
	Demonstration experiments	**9**
1	Error analysis of a given experiment	
2	Wave form generator using Op-amp	
3	PC simulations: graph, curve fitting etc.	
4	Straight edge Fresnel diffraction	
5	First order active filter.	
6	DAD instruction.	

Books and References		Author/s	Publisher	Edition	Year
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Advanced course in Practical Physics.	D. Chattopadhya, PC Rakshit& B Saha.	Book and Allied Pvt.Ltd.	(6th Edition	
2	B.Sc PRACTICAL Physics –	Harnam Singh	S.Chand& Co. Ld.	2001	
3	A test book of advanced practical PHYSICS _	SAMIR Kumar Ghosh	, New Central Book Agency	3rd edition	
4	B.Sc. Practical Physics –	CL Arora	S.Chand and Co	(1st	2001

			Ltd	Edition) -	
5	Practical Physics CL Squires	3rd Edition) Cambridge University	Cambridge University	3rd Edition)	
6	University Practical Physics –	DC Tayal.	Himalaya Publication		
7	Advanced Practical Physics –	Worsnop&Flint			